

IN THE DRAWINGS:

In the Office Action at page 2, paragraph 3, the Examiner objected to the drawings. In order to overcome these objections, replacement figures are submitted herewith. In FIGS. 1A and 1B, the legend "PRIOR ART" has been added. Approval of these changes to the Drawings is respectfully requested.

REMARKS

STATUS OF THE CLAIMS

In accordance with the foregoing, claims 1-35 have been cancelled. New claims 36-52 have been added. Claims 36-52 are pending and under consideration.

No new matter is being presented, and entry of the new claims is respectfully requested.

CHANGES TO THE DRAWINGS

On page 2, item 3, Figures 1A and 1B are objected to since they should be designated as "PRIOR ART".

Accordingly, Figures 1A and 1B have been changed to include the "PRIOR ART" label. Further, the sheets including Figures 1A and 1B have been labeled as "REPLACEMENT SHEET".

REJECTIONS OF CLAIMS 11 AND 12 UNDER 35 U.S.C. §112, SECOND PARAGRAPH

Claims 11 and 12 have been cancelled herein; however, new claims 46 and 47 substantially correspond with cancelled claims 11 and 12.

As recited in claim 46, a value obtained by subtracting a thickness T1 of the portion of the colored lower layer forming a portion of the substantially hemispherical shape from a thickness T, where T is a thickness of the colored lower layer, is not less than 0.4 μm .

That is, the difference between the thickness of the color lower layer and the portion of the colored lower layer forming a portion of the substantially hemispherical shape (the distance between line C and the transparent resin upper layer 10a, as shown in Fig. 3C, for example) is not less than 0.4 μm . (See also page 18, line 20 through page 19, line 14 of the Specification).

As recited in claim 47, a thickness T1 of a portion of the colored lower layer which forms at least a portion of the substantially hemispherical shape satisfies a condition $0.02T \leq T1 \leq 0.5T$, where T is a thickness of the colored lower layer.

That is, the thickness of the portion of the colored lower layer which forms at least a portion of the substantially hemispherical shape is greater than or equal to the thickness of the colored lower layer multiplied by 0.02, and less than or equal to the thickness of the colored lower layer multiplied by 0.5.

Therefore, it is respectfully submitted that claims 46 and 47 particularly point out and distinctly claim the subject matter of the invention and, thus, the rejection should be withdrawn.

REJECTIONS OF CLAIMS 1, 2, 5, 13 AND 17 UNDER 35 U.S.C. §102(b) AS BEING UNPATENTABLE OVER NAITO (JP 5048057)

Claims 1, 2, 5, 13 and 17 have been cancelled herein. However, new independent claim 36 corresponds substantially with combined original claims 1, 2 and 3. Claims 40, 48 and 52 correspond substantially to original claims 5, 13 and 17, respectively.

Independent claim 36 recites, "A solid-state imaging device comprising: a plurality of two-dimensionally arranged photo diodes; a plurality of microlenses which cover the respective photo diodes and which include substantially hemispherical shapes, a transparent resin upper layer which forms a portion of the substantially hemispherical shape and a colored lower layer provided between the transparent resin upper layer and the photo diode, the interface between the transparent resin upper layer and the colored lower layer being flat; and at least a portion of the colored lower layer forming a portion of the substantially hemispherical shape."

Naito discloses a solid-state imaging device; however, the substantially hemispherical microlens in Naito is not integrally structured with the color filter. (See Naito Figs. 1 and 2) That is, Naito does not teach or even suggest "at least a portion of the colored lower layer forming a portion of the substantially hemispherical shape", as recited in claim 36.

Therefore, it is respectfully submitted that claim 36 patentably distinguishes over the prior art.

Claims 40, 48 and 52 depend from claim 36 and inherit the patentable recitations thereof. Thus, it is respectfully submitted that claims 40, 48 and 52 also patentably distinguish over the prior art for at least similar reasons as well as for the features recited in those claims.

REJECTIONS OF CLAIMS 3, 10 AND 14-16 FOR OBVIOUSNESS UNDER 35 U.S.C. §103(a) AS BEING UNPATENTABLE OVER NAITO IN VIEW OF OHASHI (JP 6132505)

Claims 3, 10 and 14-16 have been cancelled herein; however, independent claim 36 corresponds substantially to combined original claims 1, 2 and 3, claim 45 corresponds substantially to original claim 10 and claims 49-51 correspond substantially to original claims 14-16, respectively.

At Office Action page 5, item 12, the Examiner notes that Naito does not teach or suggest that a portion of the colored lower layer forms at least a portion of the substantially hemispherical shape, as recited in original claim 3 and new claim 36. Hence, the Examiner cites Ohashi as disclosing this feature.

Ohashi discloses forming a lens material in a lens shape, and forming a recess section which prevents a melted lens material layer from spreading sideways when forming the

microlens.

However, the lower layer of the on-chip microlens 30, as disclosed in Ohashi, is a base material layer (transparent planarized layer) 20, and is not a colored lower layer.

Further, according to paragraph [0028] of Ohashi, in the case of a color solid-state imaging device, the colored lower layer is provided between a photoreceptor section 10 of the solid-state imaging device and the base material layer 20. Thus, it is clear that Ohashi does not disclose "at least a portion of the colored lower layer forming a portion of the substantially hemispherical shape", as recited in new independent claim 36.

In view of the foregoing, at least this feature of the device of claim 36 is missing and not taught by either of the applied references of Naito and Ohashi.

According to the present invention, moreover, the solid-state imaging device has at least a two-layer structure formed of a transparent resin upper layer and a colored lower layer, wherein the interface between the transparent resin upper layer and the colored lower layer has a flat form along the surface of a photo diode.

Thus, it is possible to include the colored lower layer in the microlens, and reduce the distance between the photoreceptor and the base of the microlens. Therefore, the light condensing performance and S/N ratio can be improved.

The light condensed by the microlens, made up of the transparent resin upper layer and color filter, passes through a portion of the color filter other than the portion made up of the lens. That is, the light condensed by the lens passes through the color filter which has a thickness necessary for color separation of the light. Therefore, as the targeted color separation is performed on the condensed light, it is possible to provide a solid-state imaging device suppressing degradation in the color purity.

Thus, it is respectfully submitted that independent claim 36 patentably distinguishes over the prior art. Claims 45 and 49-51 depend from claim 36 and inherit the patentable recitations thereof. Thus, it is respectfully submitted that claims 45 and 49-51 also patentably distinguish over the prior art for at least similar reasons as well as for the features recited in those claims.

REJECTIONS OF CLAIMS 4 AND 6 FOR OBVIOUSNESS UNDER 35 U.S.C. §103(a) AS BEING UNPATENTABLE OVER NAITO

Claims 4 and 6 are cancelled herein; however, new claims 39 and 41 correspond substantially to original claims 4 and 6, respectively.

As asserted above, Naito does not teach or suggest "at least a portion of the colored

lower layer forming a portion of the substantially hemispherical shape”, as recited in new independent claim 36.

Claims 39 and 41 depend from claim 36 and inherit the patentable recitations thereof. Thus, it is respectfully submitted that claims 39 and 41 patentably distinguish over the prior art for at least similar reasons as well as for the features recited in those claims.

REJECTION OF CLAIM 7 FOR OBVIOUSNESS UNDER 35 U.S.C. §103(a) AS BEING UNPATENTABLE OVER NAITO IN VIEW OF NAKANO ET AL. (JP 2000193819)

Claim 7 is cancelled herein; however, new claim 42 corresponds substantially to original claim 7.

New claim 42 depends from claim 36 and inherits the patentable recitations thereof. Thus, it is respectfully submitted that claim 42 patentably distinguishes over the prior art for at least similar reasons as well as for the features recited in this claim.

Further, the Examiner merely cites Nakano as disclosing an infrared absorbing layer 13a which allows for an increased visible ray transmitting rate and transparency and, therefore, lacks the teachings of claims 36 and 42 that also are missing in the Naito reference.

REJECTIONS OF CLAIMS 8 AND 9 FOR OBVIOUSNESS UNDER 35 U.S.C. §103(a) AS BEING UNPATENTABLE OVER NAITO IN VIEW OF NAKANO IN FURTHER VIEW OF MATSUMOTO ET AL. (JP 5326902)

Claims 8 and 9 are cancelled herein; however, new claims 43 and 44 substantially correspond to original claims 8 and 9, respectively.

As asserted above, neither Naito nor Nakano teaches “at least a portion of the colored lower layer forming a portion of the substantially hemispherical shape”, as recited in new independent claim 36.

Claims 43 and 44 depend from claim 36 and inherit the patentable recitations thereof. Thus, it is respectfully submitted that claims 43 and 44 patentably distinguish over the prior art for at least similar reasons as well as for the features recited in those claims.

Further, the Examiner merely cites Matsumoto et al. as disclosing a planarized layer having an ultraviolet absorbing function and, therefore, lacks the teachings of claims 43, 44 and 36 that also are missing in the Naito and Nakano references.

NEW CLAIMS 37 and 38

New claims 37 and 38 depend from claim 36 and inherit the patentable recitations thereof. Thus, it is respectfully submitted that claims 37 and 38 patentably distinguish over the

prior art for at least similar reasons as well as for the features recited in those claims.

For example, dependent claim 38 recites, "A solid-state imaging device according to claim 36, wherein a remaining portion of the colored lower layer from the interface to halfway through the colored lower layer in the thickness direction maintains a shape when the colored lower layer is formed." It is respectfully submitted that the prior art does not teach or suggest this feature.

CONCLUSION


In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot. Further, all pending claims patentably distinguish over the prior art. There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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